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JYFLTRAP Penning trap - a tool to study isomers for nuclear structure and astrophysics

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JYFLTRAP is a double Penning trap at the Ion-Guide Isotope Separator On-Line (IGISOL) facility. A large variety of nuclei can be produced with the fast and chemically non-selective IGISOL method for JYFLTRAP experiments. Thus far, around 270 atomic masses have been measured with a typical precision of around 10 ppb.

In this contribution, mass measurements of isomeric states will be discussed. JYFLTRAP is capable of measuring excitation energies of isomeric states with a precision of better than 10 keV provided that the excitation energy is high enough (> 100 keV) and the half-life long enough (> 100 ms). Mass-excess values of around 25 isomers have been measured with JYFLTRAP. The method is particularly important for beta-decaying isomers for which the excitation energies can be difficult to measure accurately by other means. In addition, JYFLTRAP has been used for in-trap conversion electron spectroscopy of isomeric states [1].

Isomers provide relevant information for nuclear structure and shell-model studies. They can also play a role in astrophysical processes. For example, the excitation energies of the proton-emitting high-spin isomer in ^{53}Co [2] as well as ^{90}Tcm ($1+$) [3] in the region relevant for the astrophysical rp-process have been measured at JYFLTRAP. Isomers close to doubly magic ^{132}Sn located at the path of astrophysical r-process have also been investigated with JYFLTRAP [4]. The measured excitation energies of the $11/2^-$ isomers in $^{121,123,125}\text{Cd}$ and $1/2^-$ isomers in $^{129,131}\text{In}$ yield new information on single-particle energies near ^{132}Sn . A good agreement has been found between the JYFLTRAP results and the well-known excitation energies of the 7- isomers in ^{130}Sn and ^{134}Sb .

[1] J. Rissanen et al., Eur. Phys. J. A 34 (2007) 113.

[2] A. Kankainen et al., Phys. Rev. C 82 (2010) 034311.

[3] A. Kankainen, submitted to Eur. Phys. J. A

[4] A. Kankainen et al., to be published

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